

SEAWATER STRONTIUM ISOTOPES AT THE CRETACEOUS-TERTIARY BOUNDARY; J.D. Macdougall and E. Martin, Scripps Institution of Oceanography, La Jolla, California.

Anomalously high values of seawater $^{87}\text{Sr}/^{86}\text{Sr}$ near the Cretaceous-Tertiary boundary have been reported by several workers (e.g. refs. 1 and 2). However, few of the data from the literature are from a single continuous section, and perhaps the most complete study of the boundary region (2), from a shallow marine limestone sequence in Alabama, showed elevated $^{87}\text{Sr}/^{86}\text{Sr}$ but no pronounced spike. Thus, in order to investigate the cause of the change in strontium isotopic composition, it is important to determine the exact nature and magnitude of the increase by studying in detail continuous sections through the boundary. If there is indeed a Sr isotope "spike" at the K-T boundary, it requires the addition of a large amount of radiogenic Sr to the oceans over a short time period, a phenomenon that may be linked to other large-scale environmental disturbances which occurred at that time. Several sources of radiogenic strontium have been suggested (1,3): a bolide with chondritic Sr concentration and isotopic composition; continental ejecta following a large impact; and continental Sr derived from acid-rain enhanced weathering. Although as hinted above the magnitude of the $^{87}\text{Sr}/^{86}\text{Sr}$ increase is not well determined, it appears that neither of the first two mechanisms could supply enough Sr to the oceans to account for the change.

In order to address this question we have initiated a high-resolution strontium isotope study of foraminifera from three Deep Sea Drilling Project (DSDP) cores which recovered the K-T boundary section: Site 356 in the South Atlantic, Site 384 in the North Atlantic and Site 577 from the Shatsky Rise in the Pacific. The isotope measurements are being made on either single or small numbers of forams carefully picked and identified and in most cases examined by SEM before analysis. Most of our data to the present are from Site 356, with a few corroborating measurements from Site 384. Because this work is not yet complete, conclusions drawn here must be viewed as tentative. However, several points can be made. First, there is a clear and very rapid increase in seawater $^{87}\text{Sr}/^{86}\text{Sr}$, as reflected in the forams, precisely at the K-T boundary. Secondly, the return to "normal" (pre-boundary) values appears to be more rapid than would be expected from the residence time of Sr in the modern oceans, although additional data will be required to confirm this observation. The absolute change in $^{87}\text{Sr}/^{86}\text{Sr}$ appears to have been considerably smaller than would be estimated from the scattered data in the literature; at Site 356 it was about 1 part in 10^4 . Nevertheless, for reasonable input values this still represents a very large influx of radiogenic Sr to the oceans, in the range of one-half to a few percent of the present oceanic Sr inventory. Even if Sr in an impacting body had carbonaceous chondrite isotopic characteristics and were completely dissolved, there would be insufficient Sr in a body of reasonable size to effect the change. Thus the increase in $^{87}\text{Sr}/^{86}\text{Sr}$ seems to require a greatly enhanced continental weathering rate, specifically enhanced weathering of silicates, at the time of the Cretaceous-Tertiary boundary.

REFERENCES: 1. Hess et. al. (1986) Science 231, 979-984; 2. Jones et. al. (1987) Geology 15, 311-315; 3. Macdougall (1988) Science 239, 485-487.